Earth Science Experiment

Analyzing Soil Samples

Soil is very important to everyone on our planet, either directly or indirectly. Soil is used to grow food that is essential to every person's survival. Soil can be used to grow grass for yards or sports fields for entertainment. It is used aesthetically as a base for foundations of buildings. Different areas of the world have different types of soil and different types of plants growing in them.

Note to teacher: Because students grow some grass or radish seeds in this experiment, it will take three to four weeks to complete. After the initial analysis of the soil, daily observations will not take much time. This experiment can be used separately or in conjunction with Eco-Connections, an Internet based environmental project (www.eco-connections.org).

Objectives

In this experiment, you will:

- Grow some grass or radish seeds
- Become familiar with some basic soil analysis techniques
- Explore the importance of analyzing soil samples

Materials

- Power Macintosh G3 or better
- ProScope Digital USB Microscope and software
- Several soil samples (including a sample of sandy soil, clay loam, and rich dirt)
- Grass or radish seeds
- Soil texture chart
- Paper towels
- Plant fertilizer (You can purchase a general fertilizer at many variety stores.)
- Water

Procedure

1. Take the first soil sample and use your sense of feel to analyze it. Record how it feels. Use your ProScope USB microscope to take pictures of your soil sample using the m0W lens and the m50 lens. Describe what the grains of soil under the microscope look like.
2. Determine if the soil in the sample feels grainy or gritty, smooth or silky, powdery or floury. Moisten the soil and describe how it feels now. Does it feel sticky? Can you squeeze it into shapes?

3. Decide if your sample contains more sand, clay, or silt particles. Use both your observations and the pictures from the microscope. Describe which of the following categories your sample falls under: clay, sandy clay, silty clay, sandy clay loam, clay loam, silty clay loam, sand, sandy loam, loam, silt loam, or silt. Explain how you made your decision.

4. Repeat the above procedure with your other soil samples.

5. Now that you have determined what type of soil makes up your samples, divide each sample into two parts. Put one-half of the sample into a small pot and plant some grass or radish seeds in it. Mix the other half of the sample with a small amount of plant fertilizer. Use only a small amount of fertilizer! Put this mixture in another small pot, and plant the same type of seeds.

6. Record the growth of the plants every two or three days. Measure the plant growth with a ruler, and by taking photographs with the ProScope USB microscope. Keep the microscope lens the same distance from the plants each time you photograph them.

7. After three to four weeks, compare the plant growth and the soil samples. Use the techniques described previously to analyze the soil. Record any differences in the two halves of each sample. Photograph each part of every sample and use the pictures to compare soil characteristics.

Data

Keep a record of your observations and pictures from the ProScope USB microscope. If a printer is available, print any pictures you took for future use. You should also construct a graph, either by hand or on a computer, of the plant growth over the four-week time period. Make a chart describing the soil samples both at the beginning and after the addition of fertilizer.

Processing the data

1. What changes did you detect in the soil samples after the grass or radishes grew in them? Did the plants grow in all of the samples? If so, did they grow equally well in all samples?
2. What explanation can you give about the differences in the growth of the plants in the various soil samples?
3. Using the materials you had in this experiment, what would you do to help promote better plant growth in a new sample that you could now create?
4. What other things could you do to help plants grow better in a soil sample you made? Could these techniques be used in larger-scale applications such as bare spots of dirt or vacant lots near your home?

Extensions

- Work in teams to research how to enrich soil samples and soil types found near your homes and around the world. You can also use the Internet to search for information on what types of plants grow best in various types of soil. This information is especially important to farmers and gardeners.
- For further investigation of soil and agriculture, visit the website of Eco-Connections (http://www.eco-connections.org).

Teacher information

- Soil is, on average, 45% mineral particles, 25% water, 25% air, and 5% organic matter. It provides a home for many insects and animals that help recycle the organic material in our ecosystem. Five to ten tons of animal life can live in an acre of topsoil. Soil also contains earthworms that are natural recyclers. They digest soil, break down organic matter, and release nutrients. One earthworm can digest 36 tons of soil in a year. Mice, moles, chipmunks, groundhogs, and other animals burrow into the ground to make their homes. This helps get air to the soil. The nuts and other food they store decompose and help put nutrients back into the soil.
- Other information on soil, soil profiles, soil composition, soil testing, and plant growth is available on the Internet, including the Eco-Connections website (www.eco-connections.org). This free, Internet-based environmental project includes modules written by teachers from the U.S. and Russia on different environmental issues. Students participating in the project can share data, answers, and ideas with their peers in schools in the U.S. and in other countries.
- In their findings, students should determine that the ProScope USB microscope enabled them to better analyze the soil samples as well as to document their scientific research. If desired, you can facilitate a discussion about the role of technology, including computers and microscopes, in scientific research.
- The final analysis of the soil may show some slight differences, but the real differences would be seen in chemical testing of the soil samples. After they complete this experiment, students could do an experiment on the chemical testing of soil samples. You can find such an experiment in the Soil and Agriculture module of the Eco-Connections project.

Sample results/Answers to questions

- The initial analysis of the soil samples should produce very different descriptions both in the physical analysis and in the pictures from the ProScope USB microscope. The grass or radishes should grow some in all of the soil samples, but will grow best in the loam. There should be differences in the samples that were treated with the fertilizer. If the same amount of fertilizer was used in each sample, these differences should be less in the sandy or clay soil than in the rich soil sample.
- You can brainstorm, based on your experiences, to come up with ways to assist plant growth in the soil samples. You may decide to use more fertilizer or to combine the soil samples to produce a superior one.
- In addition to the materials you were provided, you may deduce that adding worms or other animal or plant life might also help enrich the soil.

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